INDIANA DEPARTMENT of EDUCATION

2023 INDIANA ACADEMIC STANDARDS
MATHEMATICS

GRADE 7

Indiana Academic Standards Context and Purpose

Introduction

The Indiana Academic Standards for Grade 7 Mathematics are the result of a process designed to identify, evaluate, synthesize, and create high-quality, rigorous learning expectations for Indiana students.

Pursuant to Indiana Code (IC) 20-31-3-1(c-d), the Indiana Department of Education (IDOE) facilitated the prioritization of the Indiana Academic Standards. All standards are required to be taught. Standards identified as essential for mastery by the end of the grade level are indicated with shading and an "E." The learning outcome statement for each domain immediately precedes each set of standards.

The Indiana Academic Standards are designed to ensure that all Indiana students, upon graduation, are prepared with essential knowledge and skills needed to access employment, enrollment, or enlistment leading to service.

What are the Indiana Academic Standards and how should they be used?

The Indiana Academic Standards are designed to help educators, parents, students, and community members understand the necessary content for each grade level, and within each content area domain, to access employment, enrollment, or enlistment leading to service. These standards should form the basis for strong core instruction for all students at each grade level and content area. The standards identify the minimum academic content or skills that Indiana students need in order to be prepared for success after graduation, but they are not an exhaustive list.

While the Indiana Academic Standards establish key expectations for knowledge and skills and should be used as the basis for curriculum, the standards by themselves do not constitute a curriculum. It is the responsibility of the local school corporation to select and formally adopt curricular tools, including textbooks and any other supplementary materials, that align with Indiana Academic Standards. Additionally, corporation and school leaders should consider the appropriate instructional sequence of the standards as well as the length of time needed to teach each standard. Every standard has a unique place in the continuum of learning, but each standard will not require the same amount of time and attention. A deep understanding of the vertical articulation of the standards will enable educators to make the best instructional decisions. These standards must also be complemented by robust, evidence-based instructional practices to support overall student development. By utilizing strategic and intentional instructional practices, other areas such as STEM and employability skills can be integrated with the content standards.

Content-Specific Considerations

The Indiana Academic Standards for Grade 7 Mathematics consist of five domains: Number Sense; Ratios and Proportional Reasoning; Algebra and Functions, Geometry and Measurement; and Data Analysis, Statistics, and Probability. The skills listed in each domain indicate what students should know and be able to do in Mathematics at each grade level. The Process Standards demonstrate the ways in which students should develop conceptual understanding of mathematical content, and the ways in which students should synthesize and apply mathematical skills.

Acknowledgments

The Indiana Department of Education appreciates the time, dedication, and expertise offered by Indiana's K-12 educators, higher education professors, representatives from business and industry, families, and other stakeholders who contributed to the development of the Indiana Academic Standards. We wish to specially acknowledge the committee members, as well as participants in the public comment period, who dedicated many hours to the review and evaluation of these standards designed to prepare Indiana students for success after graduation.

Mathematics Process Standards

PS.1: Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway, rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" and "Is my answer reasonable?" They understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

PS.2: Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

PS.3: Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They analyze situations by breaking them into cases and recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions and communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is always true, sometimes, or never. Mathematically proficient students participate and collaborate in a mathematics community. They listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

PS.4: Model with mathematics.

Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. They analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

PS.5: Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Mathematically proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. Mathematically proficient students identify relevant external mathematical resources, such as digital content, and use them to pose or solve problems. They use technological tools to explore and deepen their understanding of concepts and to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication, and problem solving.

PS.6: Attend to precision.

Mathematically proficient students communicate precisely to others. They use clear definitions, including correct mathematical language, in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They express solutions clearly and logically by using the appropriate mathematical terms and notation. They specify units of measure and label axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context.

PS.7: Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. They step back for an overview and shift perspective. They recognize and use properties of operations and equality. They organize and classify geometric shapes based on their attributes. They see expressions, equations, and geometric figures as single objects or as being composed of several objects.

PS.8: Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated and look for general methods and shortcuts. They notice regularity in mathematical problems and their work to create a rule or formula. Mathematically proficient students maintain oversight of the process, while attending to the details as they solve a problem. They continually evaluate the reasonableness of their intermediate results.

Grade 7 Mathematics

Standards identified as essential for mastery by the end of the grade level are indicated with gray shading and an "E." The learning outcome statement for each domain immediately precedes each set of standards.

Number Sense	
Learning Outcome: Students connect earlier learning to express the prime factorization of whole numbers using exponents, understand the inverse relationship between perfect squares and square roots, and use number lines to compare and order rational and irrational numbers.	
7.NS.1	Show on a number line that a number and its opposite have a sum of 0 (are additive inverses). Find and interpret sums of rational numbers in real-world contexts.
7.NS.2	Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
7.NS.3	Use the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. (E)
7.NS.4	Explain that if p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$ for all nonzero integers. (E)
7.NS.5	Find the prime factorization of whole numbers and write the results using exponents.
7.NS.6	Apply the inverse relationship between squaring and finding the square root of a perfect square whole number. Find square roots of perfect square whole numbers.
7.NS.7	Compute fluently with rational numbers using an algorithmic approach. (E)
Ratios and Proportional Reasoning	
Learning Outcome: Students continue to use ratio and rate language, compute using unit rates, and use proportional relationships to solve real-world problems involving ratios and percents.	
7.RP.1	Identify the unit rate or constant of proportionality in tables, graphs, equations, and verbal descriptions of proportional relationships.
7.RP.2	Use proportional relationships to solve ratio and percent problems with multiple operations (e.g., simple interest, tax, markups, markdowns, gratuities, conversions within and across measurement systems, and percent increase and decrease). (E)
7.RP.3	Represent real-world and other mathematical situations that involve proportional relationships. Write equations and draw graphs to represent these proportional relationships. Apply the definition of unit rate to $y = mx$. (E)
Algebra and Functions	
Learning Outcome: Students use two variable equations, as well as graphs and tables, to model real-world proportional relationships and connect the constant of proportionality to the idea of slope.	
7.AF.1	Apply the properties of operations (e.g., identity, inverse, commutative, associative, distributive properties) to create equivalent linear expressions, including situations that involve factoring out a common number (e.g., given *2x - 10*, create an equivalent

	expression *2(x - 5))*. Justify each step in the process. (E)
7.AF.2	Solve real-world problems with rational numbers by using one or two operations. (E)
7.AF.3	Solve equations of the form *px + q = r* and *p(x + q) = r* fluently, where *p, q*, and *r* are specific rational numbers. Represent real-world problems using equations of these forms and solve such problems. (E)
7.AF.4	Solve inequalities of the form *px + q (> or ≥) r* or *px + q (< or ≤) r*, where *p, q*, and *r* are specific rational numbers. Represent real-world problems using inequalities of these forms and solve such problems. Graph the solution set of the inequality and interpret it in the context of the problem.
7.AF.5	Define slope as vertical change for each unit of horizontal change, and apply that a constant rate of change or constant slope describes a linear function. Identify and describe situations with constant or varying rates of change.
7.AF.6	Graph a line given its slope and a point on the line. Find the slope of a line given its graph. (E)

Geometry and Measurement

Learning Outcome: Students use scale drawings, the area and circumference of circles, and the volume of cylinders and other three-dimensional solids to solve real-world problems.

7.GM.1	Solve real-world and other mathematical problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing. Create a scale drawing by using proportional reasoning.
7.GM.2	Understand the formulas for area and circumference of a circle and use them to solve real-world and other mathematical problems; give an informal derivation of the relationship between circumference and area of a circle.
7.GM.3	Solve real-world and other mathematical problems involving volume of cylinders and three-dimensional objects composed of right rectangular prisms. (E)

Data Analysis, Statistics, and Probability

Learning Outcome: Students make inferences about populations through sampling and learn about the importance of representative samples.

7.DSP.1	Understand that statistics can be used to gain information about a population by examining a sample of the population. Understand that conclusions and generalizations about a population from a sample are valid only if the sample is representative of that population and that random sampling tends to produce representative samples and support valid inferences. (E)
7.DSP.2	Find, use, and interpret measures of central tendency (mean and median) and measures of spread (range, interquartile range, and mean absolute deviation) for numerical data from random samples to draw comparative inferences about two populations. (E)
7.DSP.3	Make observations about the degree of visual overlap of two numerical data distributions represented in line plots or box plots. Describe how data, particularly outliers, added to a data set may affect the mean and/or median.

7.DSP.4	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Understand that a probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. Understand that a probability of 1 indicates an event certain to occur and a probability of 0 indicates an event impossible to occur. Identify probabilities of events as impossible, unlikely, equally likely, likely, or certain. (E)
7.DSP.5	Develop probability models that include the sample space and probabilities of outcomes to represent simple events with equally likely outcomes. Predict the approximate relative frequency of the event based on the model. Compare probabilities from the model to observed frequencies, evaluate the level of agreement, and explain possible sources of discrepancy. (E)